quantities of seeds or spores, as it were in a supreme effort to insure the perpetuation of the species. But the laciniate forms of cultivated ferns are rather associated with abundant food and excess of vegetative vigor—conditions which always tend to produce sterility. The analogy between *B. dissectum* and the incised form of the Christmas fern is not perfect—the former, for instance, never, so far as I know, shows any evidence of being a response to environment—but it is perhaps closer than the other.—C. A. W.

On a Supposed Hybrid in Equisetum.

C. A. WEATHERBY.

There are certain groups in our flora in which species, otherwise good and generally recognized as such, are connected by puzzling intermediate forms, sometimes in a very complicated manner. In recent years a good deal of work has been directed toward explaining these forms as hybrids of the species between which they fall. Much of this work is highly valuable: it furnishes, not only a reasonable and in several cases practically proved explanation of conditions as we find them, but a means of classification at once elastic and definite enough for all practical purposes. This is very good; but when, as occasionally happens, I find a plant not uncommon in a given region determined as a hybrid between two species, one or both of which are unknown there, I begin to feel that it is possible to have too much of this good thing—that maybe theories of hybridization offer rather too easy a means of disposing of puzzling forms.

The immediate occasion of this discourse is a recent experience of mine. In 1915 Miss Ruth Holden published a study of *Equisetum variegatum* var. *Jesupi*[1] in which, from the facts that its spores were apparently

[1] Holden, Ruth, The Anatomy of a hybrid Equisetum. Am. Journ. Bot. **2**: 225–233, pls. 5–8. Aug., 1915.

abortive and its characters intermediate between those of typical *E. variegatum* and *E. hyemale*, she concluded it to be a hybrid of those two species. So far as I know, there is no reason to doubt the accuracy of Miss Holden's observations; her conclusions are persuasively and modestly stated; so far as the data given go, her article is convincing. But I recently had occasion to study and map in detail the New England ranges of *E. variegatum* and its variety *Jesupi*; and this work[2] brought out the remarkable fact that, although the general ranges of the two are, in northeastern North America, similar, they have apparently never been found growing together. The variety has been collected in quantity at Ft. Kent, Maine; the typical form is not known nearer than Ft. Fairfield, 50 miles away. The former is known from three stations in the Kennebec valley; the latter has never been found in that valley at all. Only the typical form has been found in northeastern Vermont; only the variety along the shores of Lake Champlain.[3] The points at which the two approach nearest are Salisbury and New Milford, Conn., 30 miles, and Royalton, Vt., and Summer's Falls, N. H., 20 miles apart. This evidence of the records can hardly be explained away as due to accidents of collecting. Both plants are rare enough in New England to attract attention wherever they occur and sufficiently different in appearance so that such keen and experienced collectors as Brainerd, Eggleston, Pringle, Fernald and the specialist in Equisetum, A.

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[2] This work, done as a member of a committee of the New England Botanical Club, was based primarily on the rich local collections of the Club and those of the Gray Herbarium; but the herbaria of the Boston Society of Natural History, of the Connecticut Botanical Society and of Yale University, several private collections, local floras where available and collectors' notes made specially for the purpose by members of the Club, were also consulted.

[3] Mrs. Flynn (Fl. Burlington 5. 1911) records the typical form from near Burlington; but Dr. Blake (Six Weeks' Botanizing in Vermont. Rhodora **15**: 156. 1913) could find nothing but the variety in that region and specimens very kindly sent me by Mrs. Flynn prove to be likewise referable to it.

A. Eaton, would not invariably have failed to get both if they had actually occurred together. And, to cap the climax, the second supposed parent, *E. hyemale*, var. *affine*, is unknown from northern Maine. One parent, then, is absent from all the stations for the putative hybrid, and both parents from one station, and that one of the best.

Such a situation raises puzzling questions. How can a plant be a hybrid when it is physically impossible that it should be so? That such a one as the Equisetum in point may be of remote hybrid origin cannot be certainly gainsaid; but, if so, its birth must have taken place very long ago. And a race of venerable age, which maintains itself, holds its characters and has become established outside the range of its nearest relatives, is at present a good species or variety, whatever its ultimate origin; to call it otherwise is simply to confuse definitions.[4] Nor can any theory of hybridity explain the consistent occurrence of our Equisetum in regions where one or both of its suspected parents are absent. Differences in soil preference might explain this; but, so far as we know, hybrids share the tastes of their parents in this respect.[5]

How, on the other hand, can a plant have all but the geographical ear-marks of a hybrid and not be one? Well, it often happens that sterling scientific hypotheses are given, by later scholars, a much wider application than their originators ever claimed for them.[6] We are wont to smile, nowadays, at the ingenious theories by which some evolutionists of a past generation tried to prove the serviceableness of certain characters to the plants or animals which possessed them. They as-

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[4] See, on this point, Kerner von Marilaun, Nat. Hist. Plants (Oliver's translation) **2**: 588–590, quoted in Fernald, Science N. S. **54**: 73, July 22, 1921. For some requirements which a hybrid should fulfil, see Brainerd in Bull. Vt. Bot. Club **9**: 12, 13. April, 1914.

[5] See, for instance, Wherry, Am. Fern Journ. **10**: 52. June, 1920.

[6] Cf. C. C. Nutting in Science N. S. **53**: 128. Feb. 11, 1921.

sumed, more or less unconsciously, that every character of a living species must be of benefit to it. They forgot that natural selection would eliminate only those which were actually harmful; neutral ones, neither good nor bad, might, should they chance to arise in nature's multifarious experimenting, perfectly well survive. May it not be that, in the eager study of genetics since Mendel's law was rediscovered, we have gone too far—that we are, in the case in point, a little too ready to assume that every plant of intermediate characters must be a hybrid? This would seem to carry with it the further assumption that all variation in related stocks, when it occurs, must be in divergent directions. Yet it seems that, in species which are closely related and must, therefore have had a common progenitor in no very remote past and presumably possess ancestral tendencies in common, variation would be quite as likely (through reversion, if one likes) to proceed toward as away from types closely akin. It might conceivably produce forms outwardly indistinguishable from blend hybrids: only, they should breed true and the hybrids tend to break up.

It may be objected that such a theory does not account for the imperfect spores and pollen commonly found in putative hybrids. It does not. But, to the writer's mind at least, the significance of apparently abortive spores is not so certain as some of us suppose. One would like to see more germination experiments to see whether these imperfectly developed spores are as impotent as they look. Certainly, our Equisetum, existing, as it does, apart from its reputed parents must reproduce itself somehow. And "bad" spores, or pollen, are by no means always associated with other evidences of hybridity. Brainerd and Peitersen, in their work on New England Blackberries, found the pollen of *Rubus hispidus* to be 90% imperfect. Yet

that is one of the commonest and best marked of our species: no one has ever thought of suggesting it to be a hybrid and there is no pair of species in existence of which it could be the offspring. On the other hand, *Rubus frondisentis*, a plant of intermediate characters and regarded by Brainerd and Peitersen as a hybrid, has pollen 90% perfect.[7] And sterile mutants are by no means an unknown phenomenon.

In the case of *Rubus hispidus*, the ease with which vegetative reproduction can take place may have brought about partial sterility. In that of another suspected hybrid in Equisetum, *E. litorale*, Milde has advanced an interesting conjecture.[8] He thought this might be a worn-out and dying species and its infertility a sign of fading vitality and approaching extinction. However this may be, it seems plain that the last word on the subject has yet to be spoken.

These are the reflections of one far from adequately qualified to settle the problems involved. They are not meant to do that—only to emphasize the need of considering *all* the attendant facts in such cases as that here discussed if we are to have any well-rounded and convincing explanation of them.

EAST HARTFORD, CONN.

Reminiscences of a Fern Lover.

M. A. MARSHALL.

It has been suggested that stories of "first finds" may be an encouragement to new students of the ferns, as well as pleasant reminders to those long in the ranks. Several vivid memories occur to me.

As a preface it may be said that my first lessons in field botany and plant analysis were given me as a very

[7] Bull. Vt. Agric. Exp. Sta. **217**: 43, 63, 1920.

[8] Milde Monog. Equiset. 369. 1865.